

REMARKS

The present Amendment amends claims 1-6. Therefore, the present application has pending claims 1-6.

Applicants are submitting herewith Proposed Drawing Corrections/Replacement Sheet for approval by the Examiner. Approval thereof is respectfully requested.

Claims 1, 2 and 5 stand objected to due to informalities noted by the Examiner in paragraphs 1 and 2 of the Office Action. Various amendments were made throughout claims 1, 2 and 5 to correct the informalities noted by the Examiner. Therefore, Applicants submit that these objections are overcome and should be withdrawn.

Claims 1 and 4 stand rejected under 35 USC §102(e) as being anticipated by Brown (U.S. Patent Application Publication No. 2003/0014598); claims 2, 5 and 6 stand rejected under 35 USC §103(a) as being unpatentable over Brown in view of Azagury (article entitled "Advanced Functions for Storage Subsystems: Supporting Continuous Availability"); and claim 3 stands rejected under 35 USC §103(a) as being unpatentable over Brown in view of the IBM reference (article entitled "Storage Management for IBM BS UDB: Snapshot Backup and Recovery with the IBM TotalStorage Enterprise Storage Server"). These rejections are traversed for the following reasons. Applicants submit that the features of the present invention as now more clearly recited in claims 1-6 are not taught or suggested by Brown, Azagury or the IBM reference whether taken individually or in combination with each

other as suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw these rejections.

Amendments were made to the claims so as to more clearly describe features of the present invention. Particularly, amendments were made to the claims so as to more clearly recite that the present invention is directed to a storage system for use in a computer system having a plurality of host devices and a plurality of storage systems for receiving write-in data from at least one of the host devices. According to the present invention the storage system includes a physical storage device having a logical volume for storing data, wherein the storage system is controlled so that identical data is saved across a plurality of storage systems.

The storage system as recited in the claims further includes a device for saving a time of reception at which write-in data was received from a host device in a data consistency holding table. The data consistency holding table includes a plurality of entries each indicating a corresponding relation between a reception time of write-in data, an identifier of a host which sent the write-in data to the storage system, an address at which the write-in data is to be stored, an identifier of the storage system in which the write-in data is stored and an address in a temporary storage device within which the write-in data is temporarily stored.

The storage system further includes a communication interface device for conducting bi-directional transmission of write-in data including transmitting write-in data addressed to the logical volume and a corresponding reception time to another storage system and receiving write-in data addressed to the logical volume and the corresponding reception time from the another storage system, and a data

consistency holding control, device for effecting control based on the data consistency holding table, to write-in data which was received from the host device and write-in data which was received through the communication interface device into the physical storage device after such write-in data has been made to wait in the temporary storage device for more than a predetermined time as measured from the reception time corresponding to the write-in data to the logical volume, so that when write-in data which was received from the host device and write-in data which was received through the communication interface device are written in an overlap manner into the same storage location of the physical storage device, they are written in the order as indicated by their respective reception times.

The above described features of the present invention now more clearly recited in the claims are not taught or suggested by Brown, Azagury or the IBM reference whether taken individually or in combination with each other as suggested by the Examiner.

Brown teaches a system including first and second servers of a cluster of servers being equipped with complimentary software RAID drivers and distributed lock managers that enable the first server to delegate to the second server, writing of a version of a unit of coherent data into a number of storage devices coupled to the server cluster. As per Brown, the drivers and the lock managers are designed to enable the first server to determine whether the second server is an appropriate current synchronization server target, which determination includes consideration of the last synchronization server target. Further, as per Brown, if the last synchronization server target is not an appropriate current synchronization server

target, the second server is selected among other servers of the clusters which selection may be limited to the subset of eligible servers of the cluster.

As is quite clear from the above, there is no teaching or suggestion in Brown of a computer system having a plurality of host devices and a plurality of storage systems wherein bi-directional transmission of write-in data is conducted between a first storage system and a second storage system as in the present invention as recited in the claims. This feature of the present invention is discussed, for example, on page 6, lines 4-18 and on page 10, lines 6-21 and as illustrated in Fig. 2. There is no such teaching in Brown of the bi-directional copying of write data between storage systems by a communication interface connected between the storage systems as in the present invention as recited in the claims.

Further, as is readily recognized by the Examiner there is no teaching or suggestion in Brown of a data consistency holding table according to the present invention as recited in the claims. The data consistency holding table includes various entries such as that illustrated in Fig. 5 of the present application and as discussed on page 15, line 13 through page 17, line 3 thereof.

According to the present invention, the data consistency holding table includes a plurality of entries each indicating a corresponding relation between a reception time of write-in data, an identifier of a host which sent the write-in data to the storage system, an address to which the write-in data is to be stored, an identifier of the storage system and an address in a temporary storage device within which the write-in data is temporarily stored. As per the present invention, the order of such data must be tracked being that write-in data not only comes from the immediate

storage system but also it is received from another storage system separate from the immediate storage system due to the bi-directional communication process. Thus, it is important to not only identify the write-in data but also to identify the storage system from which the write-in data including their reception times so that it is clear whether the write-in data is from the immediate storage system or another storage system separate from the immediate storage system. Such features are clearly not taught or suggested by Brown.

Further, according to the present invention, data consistency is affected by a data consistency holding control device which effects control based on the data consistency holding table. As per the present invention, write-in data which has been made to wait in the temporary storage device for more than a predetermined time as measured from the reception time corresponding to the write-in data are written after said predetermined time so that such data are written in the storage device in their respective orders of receipt. Such features are clearly not taught or suggested by Brown.

Thus, Brown fails to teach or suggest a data consistency holding table which includes a plurality of entries each indicating a corresponding relation between a reception time of write-in data, an identifier of a host which sent the write-in data to the storage system, an address at which the write-in data is to be stored, an identifier of the storage system in which the write-in data is stored and an address in a temporary storage device within which the write-in data is temporarily stored as recited in the claims.

Further, Brown fails to teach or suggest a communication interface device for conducting bi-directional transmission of write-in data including transmitting write-in data addressed to the logical volume and a corresponding reception time to another storage system and receiving write-in data addressed to the logical volume and the corresponding reception time from the another storage system as recited in the claims.

Still further, Brown fails to teach or suggest a data consistency holding control device for affecting control, based on the data consistency holding table, to write write-in data which was received from the host device and write-in data which was received through the communication interface device into the physical storage device after such write-in data has been made to wait in the temporary storage device for more than a predetermined time as measured from the reception time corresponding to the write-in data to the logical volume, so that, when write-in data which was received from the host device and write-in data which was received through the communication interface device are written in an overlap manner into the same storage location of the physical storage device, they are written in the order as indicated by their respective reception times as recited in the claims.

Therefore, as is clear from the above, Brown fails to teach or suggest the features of the present invention as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 USC §102(e) rejection of claims 1 and 4 as being anticipated by Brown is respectfully requested.

The above noted deficiencies of Brown are not supplied by any of the other references of record whether taken individually or in combination with each other.

Particularly, the above described features of the present invention as now more clearly recited in the claims are not taught or suggested by Azagury or the IBM reference. Accordingly, the combination of Brown and one or more of Azagury and the IBM reference fails to teach or suggest the features of the present invention as now more clearly recited in the claims.

Azagury was relied upon by the Examiner for an alleged teaching of a data consistency holding table on page 6 the fourth paragraph thereof. Upon review of this passage of Azagury it is quite clear that Azagury merely teaches that a control unit places information about data that was modified by the host modified on a queue of updates called a side file, wherein this information includes a time stamp provided by the host and a pointer to the modified data which are in the control unit cache. Azagury further teaches that after the information is queued and normal write processing is complete, the control unit signals the successful completion of the write operation to the host.

The above described teachings of Azagury is not in anyway related to the data consistency holding table as recited in the claims which is intended to control the order of write data into a storage system since the storage system is part of a computer system having a plurality of storage systems that allows for bi-directional transmission of write-in data between the storage systems. Thus, according to the present invention as recited in the claims an acute need exists for maintaining the order of write-in data since such write-in data may come from the immediate storage system and also from another storage system different from the immediate storage

system to which the immediate storage system is connected for bi-directional transmissions. There is no such need in Azagury.

Further, there is no teaching or suggestion in Azagury of any information being stored as part of the side file other than a time stamp and a pointer to the modified data. As per the present invention, the data consistency holding table includes a plurality of entries each indicating a corresponding relation between a reception time of write-in data, an identifier of a host which sent the write-in data to the storage system, an address to which the write-in data is to be stored, an identifier of the storage system in which the write-in data is stored and an address in a temporary storage device within which the write-in data is temporarily stored. Such information which tracks not only reception times but the particular storage system to which the write-in data is to be directed, whether the immediate storage system or another storage system, are clearly not taught or suggested by Azagury.

Thus, Azagury fails to teach or suggest a data consistency holding table which includes a plurality of entries each indicating a corresponding relation between a reception time of write-in data, an identifier of a host which sent the write-in data to the storage system, an address to which the write-in data is to be stored, an identifier of the storage system in which the write-in data is stored and an address in a temporary storage device within which the write-in data is temporarily stored as recited in the claims.

Further, Azagury fails to teach or suggest a communication interface device for conducting bi-directional transmission of write-in data including transmitting write-in data addressed to the logical volume and a corresponding reception time to

another storage system and receiving write-in data addressed to the logical volume and the corresponding reception time from the another storage system as recited in the claims.

Still further, Azagury fails to teach or suggest a data consistency holding control device for affecting control, based on the data consistency holding table, to write write-in data which was received from the host device and write-in data which was received through the communication interface device into the physical storage device after such write-in data has been made to wait in the temporary storage device for more than a predetermined time as measured from the reception time corresponding to the write-in data to the logical volume, so that, when write-in data which was received from the host device and write-in data which was received through the communication interface device are written in an overlap manner into the same storage location of the physical storage device, they are written in the order as indicated by their respective reception times as recited in the claims.

Therefore, Azagury suffers from the same deficiencies relative to the features of the present invention as recited in the claims as Brown and as such the combination of Brown and Azagury fail to teach or suggest the features of the present invention as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 USC §103(a) rejection of claims 2, 5 and 6 as being unpatentable over Brown in view of Azagury is respectfully requested.

The above noted deficiencies of both Brown and Azagury are also evident in the IBM reference. In fact, claim 3 depends from claim 1 and as such includes all of the features recited in the claim shown above not to be taught or suggested by

Brown. These very same features are also not taught or suggested by the IBM reference.

Thus, the features of the present invention as now more clearly recited in the claims are not taught or suggested by the IBM reference, the same as Brown and Azagury. Therefore, combining the teachings of Brown and the IBM reference in the manner suggested by the Examiner in the Office Action still fails to teach or suggest the features of the present invention as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 USC §103(a) rejection of claim 3 as being unpatentable over Brown and the IBM reference is respectfully requested.

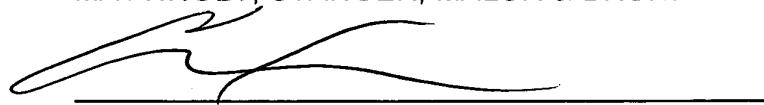
The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references utilized in the rejection of claims 1-6.

In view of the foregoing amendments and remarks, applicants submit that claims 1-6 are in condition for allowance. Accordingly, early allowance of claims 1-6 is respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C., Deposit Account No. 50-1417 (501.43387X00).

Respectfully submitted,

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